

Appendix C – Data Resources

Table I: Volume conversion

The following table provides unit conversion factors for volume calculation:

The actual number of a type of unit in the first column should be multiplied by the appropriate factor to convert to the indicated type of unit in the succeeding columns.

	meter³	centimeter³	liter	foot³	inch³
cubic meters	1	10 ⁶	1000	35.31	6.102x10 ⁴
cubic centimeters	10 ⁻⁶	1	10 ⁻³	3.531x10 ⁻⁵	6.102x10 ⁻²
liters	10 ⁻³	1000	1	3.531x10 ⁻²	61.02
cubic feet	2.832x10 ⁻²	2.832x10 ⁴	28.32	1	1728
cubic inches	1.639x10 ⁻⁵	16.39	1.639x10 ⁻²	5.787x10 ⁻⁴	1

1 U.S fluid gallon = 4 U.S fluid quarts = 8 U.S pints = 128 U.S. fluid ounces = 231 in³

1 British imperial gallon = 277.4 in³

1 liter = 10⁻³ m³

HINT: To change from gallons to m³ (cubic meters), multiply the amount of gallons (volume) by the quantity 1.6387x10⁻⁵ times 231.

Note: “x” means multiply

Table II: Length conversion

The following table provides unit conversion factors for length calculation

The actual number of a type of unit in the first column should be multiplied by the appropriate factor to convert to the indicated type of unit in the succeeding columns.

	centimeters	meters	kilometers	inches	feet	miles
centimeters	1	10 ⁻²	10 ⁻⁵	0.3937	3.281x10 ⁻²	6.214x10 ⁻⁶
meters	100	1	10 ⁻³	39.37	3.281	6.214x10 ⁻⁴
kilometers	10 ⁵	1000	1	3.937x10 ⁴	3281	0.6214
inches	2.540	2.54x10 ⁻²	2.54x10 ⁻⁵	1	8.33x10 ⁻²	1.57x10 ⁻⁵
feet	30.48	0.3048	3.04x10 ⁻⁴	12	1	1.89x10 ⁻⁴
miles	1.60x10 ⁵	1609	1.609	6.33x10 ⁴	5280	1

Specific Hazardous Substances

Tables III and IV list the specific petroleum products and chemicals defined to be hazardous substances under 24 CFR Part 51.201. It should be noted that the listed chemicals do not represent the “universe” of hazardous liquids and gases that can produce blast over pressure or thermal radiation levels in excess of the standards. The listed hazardous substances to which the regulations apply are common fuels used mostly for domestic and industrial purposes. Tables III and IV include the specific petroleum products listed in Appendix I of Subpart C of Part 51. The Regulation applies to chemicals in stationary above ground containers in excess of 100 gallons. (See Table III for the list of chemicals.). The Regulation applies to chemicals contained in stationary above ground containers of any capacity. (See Table IV for the list of chemicals.)

Tables V and VI list suggested hazardous liquids or gases that are not common industrial fuels and are not listed in Appendix I of Subpart C of Part 51. The listed chemicals on tables V and VI are not inclusive of the specific petroleum products listed in the Appendix I of Subpart C of Part 51. As stated in 24 CFR Part 51.207, there is a requirement for applications of the regulation 24 CFR 51C with respect to a substance not listed in Appendix I to the Subpart C that would create thermal or overpressure effect in excess of that listed in 24 CFR 51.203. Keep in mind that compliance with Regulation 24 CFR Part 51 Subpart C may be subject to the chemicals listed on tables V and VI of this *Guidebook*. The Regulation applies to chemicals contained in stationary above ground containers of any capacity. (See Tables V and VI for the list of chemicals.)

Table III - Hazardous Liquids

Acetic Acid	Crude Oil (Petroleum)	Isobutyl Alcohol
Acetic Anhydride	Cumene	Isopropyl Acetate
Acetone	Cyclohexane	Isopropyl Alcohol
Acrylonitrile	No. 2 Diesel Fuel	Jet Fuel and Kerosene
Amyl Acetate	Ethyl Acetate	Methyl Alcohol
Amyl Alcohol	Ethyl Acrylate	Methyl Amyl Alcohol
Benzene	Ethyl Alcohol	Methyl Cellosolve
Butyl Acetate	Ethyl Benzene	Methyl Ethyl Ketone
Butyl Acrylate	Ethyl Dichloride	Naphtha
Butyl Alcohol	Ethyl Ether	Pentane
Carbon Bisulfide	Gasoline	Propylene Oxide
Carbon Disulfide	Heptane	Toluene
Cellosolve	Hexane	Vinyl Acetate
Cresols	Isobutyl Acetate	Xylene

Table IV - Hazardous Gases

Acetaldehyde	Ethylene	Liquefied Petroleum Gas (LPG)
Butadiene	Ethylene Oxide	Propane
Butane	Hydrogen	Propylene
Ethene	Liquefied Natural Gas (LNG)	Vinyl Chloride

Table V - Hazardous Liquids

Acrylyl Chloride	Ethanol	Nickel Carbonyl
Allylamine	2-Ethoxyethanol	Propyl Acetate
Aviation Gas (motor propulsion, not Jet propulsion, i.e Jet Fuel)	Ethyl Mercaptan	Pyridine
Buthyl Methyl Ketone	Ethylamine	1-3 Pentadiene
2-Chloropropene	Ethyleneimine	1-Pentene
Crotonaldehyde	Furan	2-Pentene (Z)
Crotonaldehyde (E)	Hydrazine	Piperidine
Cyclohexanone	Iron Pentacarbonyl	Styrene
1,1 Dichloroethane	Isopentane	Tetrahydrofuran
1,2 Dichloroethane	Isoprene	Tetramethylsilane
Diethylamine	Isopropyl Chloride	Tetranitromethane
Diethylether	Isopropylamine	Trichlorosilane
Diisobutyl Ketone	Methanol	1-1-1 Trichloroethane
Diisopropyl Ether	Methyl Acetate	Trimethylchlorosilane
1,4 Dioxane	2-Methyl-1 butene	Vinyl Ethyl Ether
Diethyleneglycoldinitrate	Methyl Chloroformate	Vinylidene Chloride
1,1 Dimethylhydrazine	Methyl Formate	M-Xylene
Dimethyldicholasilane	Methylamine	O-Xylene
Epichlorohydrin	Methyltrichlorosilane	P-Xylene

Table VI - Hazardous Gases

Acetylene	Dimethylamine	Silane
Butene	Dimethyl Ether	Propadiene
2-Butene	2,2 Dimethylpropane	Propyne
Dichlorosilane	2-Pentene, (E)	
Difluoroethane	Phosphine	

Container Conversion Chart (Dimensions to Gallons)

Container Diameter (Feet)	Height or Length of Container (Feet)									
	1	2	3	4	5	6	7	8	9	10
1	6	12	18	24	29	35	41	47	53	59
2	24	47	71	94	118	141	165	188	212	235
3	53	106	159	212	264	317	370	423	476	529
4	94	188	282	376	470	564	658	752	846	940
5	147	294	441	588	734	881	1028	1175	1322	1469
6	212	423	635	846	1058	1269	1481	1692	1904	2115
7	288	576	864	1152	1440	1727	2015	2303	2591	2879
8	376	752	1128	1504	1880	2256	2632	3008	3384	3760
9	476	952	1428	1904	2380	2856	3331	3807	4283	4759
10	588	1175	1763	2350	2938	3525	4113	4700	5288	5876
11	711	1422	2133	2844	3555	4266	4977	5688	6398	7109
12	846	1692	2538	3384	4230	5076	5923	6769	7615	8461
13	993	1986	2979	3972	4965	5958	6951	7944	8937	9930
14	1152	2303	3455	4606	5758	6910	8061	9213	10364	11516
15	1322	2644	3966	5288	6610	7932	9254	10576	11898	13220
16	1504	3008	4512	6017	7521	9025	10529	12033	13537	15041
17	1698	3396	5094	6792	8490	10188	11886	13584	15282	16980
18	1904	3807	5711	7615	9518	11422	13326	15229	17133	19037
19	2121	4242	6363	8484	10605	12726	14848	16969	19090	21211
20	2350	4700	7051	9401	11751	14101	16452	18802	21152	23502
21	2591	5182	7773	10364	12956	15547	18138	20729	23320	25911
22	2844	5688	8531	11375	14219	17063	19906	22750	25594	28438
23	3108	6216	9325	12433	15541	18649	21757	24865	27974	31082
24	3384	6769	10153	13537	16922	20306	23690	27075	30459	33843

25	3672	7344	11017	14689	18361	22033	25706	29378	33050	36722
26	3972	7944	11916	15888	19859	23831	27803	31775	35747	39719
27	4283	8567	12850	17133	21416	25700	29983	34266	38550	42833
28	4606	9213	13819	18426	23032	27639	32245	36852	41458	46064
29	4941	9883	14824	19765	24707	29648	34589	39531	44472	49413
30	5288	10576	15864	21152	26440	31728	37016	42304	47592	52880
Container Diameter (Feet)	Height or Length of Container (Feet)									
	11	12	13	14	15	16	17	18	19	20
1	65	71	76	82	88	94	100	106	112	118
2	259	282	306	329	353	376	400	423	447	470
3	582	635	687	740	793	846	899	952	1005	1058
4	1034	1128	1222	1316	1410	1504	1598	1692	1786	1880
5	1616	1763	1910	2056	2203	2350	2497	2644	2791	2938
6	2327	2538	2750	2961	3173	3384	3596	3807	4019	4230
7	3167	3455	3743	4031	4319	4606	4894	5182	5470	5758
8	4136	4512	4888	5265	5641	6017	6393	6769	7145	7521
9	5235	5711	6187	6663	7139	7615	8091	8567	9042	9518
10	6463	7051	7638	8226	8813	9401	9988	10576	11164	11751
11	7820	8531	9242	9953	10664	11375	12086	12797	13508	14219
12	9307	10153	10999	11845	12691	13537	14383	15229	16076	16922
13	10923	11916	12909	13902	14895	15888	16880	17873	18866	19859
14	12668	13819	14971	16123	17274	18426	19577	20729	21881	23032
15	14542	15864	17186	18508	19830	21152	22474	23796	25118	26440
16	16546	18050	19554	21058	22562	24066	25570	27075	28579	30083
17	18678	20376	22074	23773	25471	27169	28867	30565	32263	33961
18	20941	22844	24748	26652	28555	30459	32363	34266	36170	38074
19	23332	25453	27574	29695	31816	33937	36058	38179	40300	42422
20	25852	28203	30553	32903	35253	37604	39954	42304	44654	47005

Container Diameter (Feet)	Height or Length of Container (Feet)									
	21	22	23	24	25	26	27	28	29	30
21	28502	31093	33685	36276	38867	41458	44049	46640	49231	51822
22	31282	34125	36969	39813	42657	45500	48344	51188	54032	56875
23	34190	37298	40406	43514	46623	49731	52839	55947	59055	62163
24	37228	40612	43996	47381	50765	54149	57534	60918	64302	67686
25	40395	44067	47739	51411	55083	58756	62428	66100	69772	73445
26	43691	47663	51634	55606	59578	63550	67522	71494	75466	79438
27	47116	51399	55683	59966	64249	68533	72816	77099	81382	85666
28	50671	55277	59884	64490	69097	73703	78310	82916	87522	92129
29	54355	59296	64238	69179	74120	79062	84003	88944	93886	98827
30	58168	63456	68744	74032	79320	84608	89896	95184	100472	105760
1	123	129	135	141	147	153	159	165	170	176
2	494	517	541	564	588	611	635	658	682	705
3	1110	1163	1216	1269	1322	1375	1428	1481	1534	1586
4	1974	2068	2162	2256	2350	2444	2538	2632	2726	2820
5	3085	3232	3378	3525	3672	3819	3966	4113	4260	4407
6	4442	4653	4865	5076	5288	5500	5711	5923	6134	6346
7	6046	6334	6622	6910	7198	7485	7773	8061	8349	8637
8	7897	8273	8649	9025	9401	9777	10153	10529	10905	11281
9	9994	10470	10946	11422	11898	12374	12850	13326	13802	14278
10	12339	12926	13514	14101	14689	15276	15864	16452	17039	17627
11	14930	15641	16352	17063	17774	18485	19195	19906	20617	21328
12	17768	18614	19460	20306	21152	21998	22844	23690	24536	25382
13	20852	21845	22838	23831	24824	25817	26810	27803	28796	29789
14	24184	25335	26487	27639	28790	29942	31093	32245	33397	34548
15	27762	29084	30406	31728	33050	34372	35694	37016	38338	39660

16	31587	33091	34595	36099	37604	39108	40612	42116	43620	45124
17	35659	37357	39055	40753	42451	44149	45847	47545	49243	50941
18	39977	41881	43785	45688	47592	49496	51399	53303	55207	57110
19	44543	46664	48785	50906	53027	55148	57269	59390	61511	63632
20	49355	51705	54055	56405	58756	61106	63456	65806	68157	70507
21	54414	57005	59596	62187	64778	67369	69960	72551	75143	77734
22	59719	62563	65407	68251	71094	73938	76782	79626	82469	85313
23	65272	68380	71488	74596	77704	80813	83921	87029	90137	93245
24	71071	74455	77839	81224	84608	87992	91377	94761	98145	101530
25	77117	80789	84461	88133	91806	95478	99150	102822	106495	110167
26	83410	87381	91353	95325	99297	103269	107241	111213	115185	119156
27	89949	94232	98516	102799	107082	111365	115649	119932	124215	128499
28	96735	101342	105948	110555	115161	119767	124374	128980	133587	138193
29	103768	108710	113651	118592	123534	128475	133416	138358	143299	148240
30	111048	116336	121624	126912	132200	137488	142776	148064	153352	158640

Container Diameter (Feet)	Height or Length of Container (Feet)									
	31	32	33	34	35	36	37	38	39	40
1	182	188	194	200	206	212	217	223	229	235
2	729	752	776	799	823	846	870	893	917	940
3	1639	1692	1745	1798	1851	1904	1957	2009	2062	2115
4	2914	3008	3102	3196	3290	3384	3478	3572	3666	3760
5	4554	4700	4847	4994	5141	5288	5435	5582	5729	5876
6	6557	6769	6980	7192	7403	7615	7826	8038	8249	8461
7	8925	9213	9501	9789	10077	10364	10652	10940	11228	11516
8	11657	12033	12409	12785	13161	13537	13913	14289	14665	15041
9	14754	15229	15705	16181	16657	17133	17609	18085	18561	19037
10	18214	18802	19389	19977	20564	21152	21740	22327	22915	23502
11	22039	22750	23461	24172	24883	25594	26305	27016	27727	28438

12	26229	27075	27921	28767	29613	30459	31305	32151	32997	33843
13	30782	31775	32768	33761	34754	35747	36740	37733	38726	39719
14	35700	36852	38003	39155	40306	41458	42610	43761	44913	46064
15	40982	42304	43626	44948	46270	47592	48914	50236	51558	52880
16	46628	48133	49637	51141	52645	54149	55653	57157	58662	60166
17	52639	54337	56035	57733	59431	61129	62827	64525	66223	67922
18	59014	60918	62822	64725	66629	68533	70436	72340	74244	76147
19	65753	67875	69996	72117	74238	76359	78480	80601	82722	84843
20	72857	75207	77557	79908	82258	84608	86958	89309	91659	94009
21	80325	82916	85507	88098	90689	93280	95872	98463	101054	103645
22	88157	91001	93845	96688	99532	102376	105220	108063	110907	113751
23	96353	99462	102570	105678	108786	111894	115002	118111	121219	124327
24	104914	108298	111683	115067	118451	121836	125220	128604	131989	135373
25	113839	117511	121184	124856	128528	132200	135872	139545	143217	146889
26	123128	127100	131072	135044	139016	142988	146960	150931	154903	158875
27	132782	137065	141348	145632	149915	154198	158482	162765	167048	171331
28	142800	147406	152013	156619	161225	165832	170438	175045	179651	184258
29	153182	158123	163065	168006	172947	177889	182830	187771	192713	197654
30	163928	169216	174504	179792	185080	190368	195656	200944	206232	211520

Container Diameter (Feet)	Height or Length of Container (Feet)									
	41	42	43	44	45	46	47	48	49	50
1	241	247	253	259	264	270	276	282	288	294
2	964	987	1011	1034	1058	1081	1105	1128	1152	1175
3	2168	2221	2274	2327	2380	2432	2485	2538	2591	2644
4	3854	3948	4042	4136	4230	4324	4418	4512	4606	4700
5	6022	6169	6316	6463	6610	6757	6904	7051	7198	7344
6	8672	8884	9095	9307	9518	9730	9941	10153	10364	10576
7	11804	12092	12380	12668	12956	13244	13531	13819	14107	14395

8	15417	15794	16170	16546	16922	17298	17674	18050	18426	18802
9	19513	19989	20465	20941	21416	21892	22368	22844	23320	23796
10	24090	24677	25265	25852	26440	27028	27615	28203	28790	29378
11	29149	29860	30571	31282	31992	32703	33414	34125	34836	35547
12	34689	35535	36381	37228	38074	38920	39766	40612	41458	42304
13	40712	41705	42698	43691	44684	45677	46670	47663	48656	49649
14	47216	48368	49519	50671	51822	52974	54126	55277	56429	57581
15	54202	55524	56846	58168	59490	60812	62134	63456	64778	66100
16	61670	63174	64678	66182	67686	69191	70695	72199	73703	75207
17	69620	71318	73016	74714	76412	78110	79808	81506	83204	84902
18	78051	79955	81858	83762	85666	87569	89473	91377	93280	95184
19	86964	89085	91206	93327	95449	97570	99691	101812	103933	106054
20	96359	98709	101060	103410	105760	108110	110461	112811	115161	117511
21	106236	108827	111418	114009	116601	119192	121783	124374	126965	129556
22	116595	119438	122282	125126	127970	130814	133657	136501	139345	142189
23	127435	130543	133651	136760	139868	142976	146084	149192	152300	155409
24	138757	142142	145526	148910	152295	155679	159063	162448	165832	169216
25	150561	154234	157906	161578	165250	168922	172595	176267	179939	183611
26	162847	166819	170791	174763	178735	182707	186678	190650	194622	198594
27	175615	179898	184181	188465	192748	197031	201314	205598	209881	214164
28	188864	193471	198077	202683	207290	211896	216503	221109	225716	230322
29	202595	207537	212478	217419	222361	227302	232243	237185	242126	247067
30	216808	222096	227384	232672	237960	243248	248536	253824	259112	264400

Container Diameter (Feet)	Height or Length of Container (Feet)									
	51	52	53	54	55	56	57	58	59	60
1	300	306	311	317	323	329	335	341	347	353
2	1199	1222	1246	1269	1293	1316	1340	1363	1387	1410
3	2697	2750	2803	2856	2908	2961	3014	3067	3120	3173

4	4794	4888	4982	5076	5170	5265	5359	5453	5547	5641
5	7491	7638	7785	7932	8079	8226	8373	8520	8666	8813
6	10788	10999	11211	11422	11634	11845	12057	12268	12480	12691
7	14683	14971	15259	15547	15835	16123	16410	16698	16986	17274
8	19178	19554	19930	20306	20682	21058	21434	21810	22186	22562
9	24272	24748	25224	25700	26176	26652	27127	27603	28079	28555
10	29965	30553	31140	31728	32316	32903	33491	34078	34666	35253
11	36258	36969	37680	38391	39102	39813	40524	41235	41946	42657
12	43150	43996	44842	45688	46534	47381	48227	49073	49919	50765
13	50641	51634	52627	53620	54613	55606	56599	57592	58585	59578
14	58732	59884	61035	62187	63339	64490	65642	66793	67945	69097
15	67422	68744	70066	71388	72710	74032	75354	76676	77998	79320
16	76711	78216	79720	81224	82728	84232	85736	87240	88745	90249
17	86600	88298	89996	91694	93392	95090	96788	98486	100184	101882
18	97088	98991	100895	102799	104703	106606	108510	110414	112317	114221
19	108175	110296	112417	114538	116659	118780	120901	123023	125144	127265
20	119862	122212	124562	126912	129262	131613	133963	136313	138663	141014
21	132147	134738	137330	139921	142512	145103	147694	150285	152876	155467
22	145032	147876	150720	153564	156408	159251	162095	164939	167783	170626
23	158517	161625	164733	167841	170950	174058	177166	180274	183382	186490
24	172601	175985	179369	182754	186138	189522	192907	196291	199675	203059
25	187284	190956	194628	198300	201973	205645	209317	212989	216661	220334
26	202566	206538	210510	214482	218453	222425	226397	230369	234341	238313
27	218448	222731	227014	231297	235581	239864	244147	248431	252714	256997
28	234929	239535	244141	248748	253354	257961	262567	267174	271780	276387
29	252009	256950	261892	266833	271774	276716	281657	286598	291540	296481
30	269688	274976	280264	285552	290840	296128	301416	306704	311992	317280

Container Diameter (Feet)	Height or Length of Container (Feet)									
	1	2	3	4	5	6	7	8	9	10
31	5646	11293	16939	22586	28232	33879	39525	45171	50818	56464
32	6017	12033	18050	24066	30083	36099	42116	48133	54149	60166
33	6398	12797	19195	25594	31992	38391	44789	51188	57586	63985
34	6792	13584	20376	27169	33961	40753	47545	54337	61129	67922
35	7198	14395	21593	28790	35988	43185	50383	57581	64778	71976
36	7615	15229	22844	30459	38074	45688	53303	60918	68533	76147
37	8044	16087	24131	32175	40218	48262	56306	64349	72393	80436
38	8484	16969	25453	33937	42422	50906	59390	67875	76359	84843
39	8937	17873	26810	35747	44684	53620	62557	71494	80431	89367
40	9401	18802	28203	37604	47005	56405	65806	75207	84608	94009
41	9877	19754	29630	39507	49384	59261	69138	79015	88891	98768
42	10364	20729	31093	41458	51822	62187	72551	82916	93280	103645
43	10864	21728	32592	43456	54320	65184	76047	86911	97775	108639
44	11375	22750	34125	45500	56875	68251	79626	91001	102376	113751
45	11898	23796	35694	47592	59490	71388	83286	95184	107082	118980
46	12433	24865	37298	49731	62163	74596	87029	99462	111894	124327
47	12979	25958	38937	51916	64896	77875	90854	103833	116812	129791
48	13537	27075	40612	54149	67686	81224	94761	108298	121836	135373
49	14107	28214	42322	56429	70536	84643	98751	112858	126965	141072
50	14689	29378	44067	58756	73445	88133	102822	117511	132200	146889
51	15282	30565	45847	61129	76412	91694	106976	122259	137541	152823
52	15888	31775	47663	63550	79438	95325	111213	127100	142988	158875
53	16504	33009	49513	66018	82522	99027	115531	132036	148540	165045
54	17133	34266	51399	68533	85666	102799	119932	137065	154198	171331
55	17774	35547	53321	71094	88868	106641	124415	142189	159962	177736

56	18426	36852	55277	73703	92129	110555	128980	147406	165832	184258
57	19090	38179	57269	76359	95449	114538	133628	152718	171807	190897
58	19765	39531	59296	79062	98827	118592	138358	158123	177889	197654
59	20453	40906	61359	81811	102264	122717	143170	163623	184076	204528
60	21152	42304	63456	84608	105760	126912	148064	169216	190368	211520
Container Diameter (Feet)	Height or Length of Container (Feet)									
	11	12	13	14	15	16	17	18	19	20
31	62111	67757	73403	79050	84696	90343	95989	101636	107282	112928
32	66182	72199	78216	84232	90249	96265	102282	108298	114315	120332
33	70383	76782	83180	89579	95977	102376	108774	115173	121571	127970
34	74714	81506	88298	95090	101882	108674	115467	122259	129051	135843
35	79173	86371	93568	100766	107963	115161	122359	129556	136754	143951
36	83762	91377	98991	106606	114221	121836	129450	137065	144680	152295
37	88480	96524	104567	112611	120655	128698	136742	144786	152829	160873
38	93327	101812	110296	118780	127265	135749	144233	152718	161202	169686
39	98304	107241	116178	125114	134051	142988	151924	160861	169798	178735
40	103410	112811	122212	131613	141014	150414	159815	169216	178617	188018
41	108645	118522	128399	138276	148152	158029	167906	177783	187660	197536
42	114009	124374	134738	145103	155467	165832	176196	186561	196925	207290
43	119503	130367	141231	152095	162959	173823	184687	195551	206414	217278
44	125126	136501	147876	159251	170626	182001	193377	204752	216127	227502
45	130878	142776	154674	166572	178470	190368	202266	214164	226062	237960
46	136760	149192	161625	174058	186490	198923	211356	223788	236221	248654
47	142770	155749	168729	181708	194687	207666	220645	233624	246603	259582
48	148910	162448	175985	189522	203059	216597	230134	243671	257209	270746
49	155180	169287	183394	197501	211608	225716	239823	253930	268037	282145
50	161578	176267	190956	205645	220334	235023	249711	264400	279089	293778
51	168106	183388	198670	213953	229235	244517	259800	275082	290364	305647

52	174763	190650	206538	222425	238313	254200	270088	285975	301863	317750
53	181549	198054	214558	231062	247567	264071	280576	297080	313585	330089
54	188465	205598	222731	239864	256997	274130	291263	308397	325530	342663
55	195509	213283	231057	248830	266604	284377	302151	319924	337698	355472
56	202683	221109	239535	257961	276387	294812	313238	331664	350090	368515
57	209987	229076	248166	267256	286346	305435	324525	343615	362704	381794
58	217419	237185	256950	276716	296481	316246	336012	355777	375543	395308
59	224981	245434	265887	286340	306793	327245	347698	368151	388604	409057
60	232672	253824	274976	296128	317280	338432	359585	380737	401889	423041
Container Diameter (Feet)	Height or Length of Container (Feet)									
	21	22	23	24	25	26	27	28	29	30
31	118575	124221	129868	135514	141160	146807	152453	158100	163746	169393
32	126348	132365	138381	144398	150414	156431	162448	168464	174481	180497
33	134368	140767	147165	153564	159962	166361	172759	179158	185556	191955
34	142635	149427	156219	163012	169804	176596	183388	190180	196972	203765
35	151149	158346	165544	172742	179939	187137	194334	201532	208729	215927
36	159909	167524	175139	182754	190368	197983	205598	213212	220827	228442
37	168917	176960	185004	193048	201091	209135	217178	225222	233266	241309
38	178171	186655	195139	203624	212108	220592	229076	237561	246045	254529
39	187671	196608	205545	214482	223418	232355	241292	250229	259165	268102
40	197419	206820	216221	225622	235023	244423	253824	263225	272626	282027
41	207413	217290	227167	237044	246921	256797	266674	276551	286428	296305
42	217654	228019	238383	248748	259112	269477	279841	290206	300570	310935
43	228142	239006	249870	260734	271598	282462	293326	304190	315054	325918
44	238877	250252	261627	273002	284377	295752	307127	318503	329878	341253
45	249858	261756	273654	285552	297450	309348	321246	333144	345042	356940
46	261087	273519	285952	298385	310817	323250	335683	348115	360548	372981
47	272562	285541	298520	311499	324478	337457	350436	363415	376394	389374

48	284283	297821	311358	324895	338432	351970	365507	379044	392582	406119
49	296252	310359	324466	338573	352681	366788	380895	395002	409110	423217
50	308467	323156	337845	352534	367223	381912	396601	411289	425978	440667
51	320929	336212	351494	366776	382059	397341	412623	427906	443188	458470
52	333638	349526	365413	381301	397188	413076	428963	444851	460738	476626
53	346594	363098	379603	396107	412611	429116	445620	462125	478629	495134
54	359796	376929	394062	411195	428329	445462	462595	479728	496861	513994
55	373245	391019	408792	426566	444340	462113	479887	497660	515434	533207
56	386941	405367	423793	442218	460644	479070	497496	515922	534347	552773
57	400884	419974	439063	458153	477243	496332	515422	534512	553601	572691
58	415073	434839	454604	474370	494135	513900	533666	553431	573196	592962
59	429510	449962	470415	490868	511321	531774	552227	572679	593132	613585
60	444193	465345	486497	507649	528801	549953	571105	592257	613409	634561
Container Diameter (Feet)	Height or Length of Container (Feet)									
	31	32	33	34	35	36	37	38	39	40
31	175039	180685	186332	191978	197625	203271	208917	214564	220210	225857
32	186514	192530	198547	204564	210580	216597	222613	228630	234647	240663
33	198353	204752	211150	217549	223947	230346	236744	243143	249541	255940
34	210557	217349	224141	230933	237725	244517	251310	258102	264894	271686
35	223125	230322	237520	244717	251915	259112	266310	273507	280705	287903
36	236057	243671	251286	258901	266516	274130	281745	289360	296974	304589
37	249353	257397	265440	273484	281528	289571	297615	305659	313702	321746
38	263014	271498	279982	288467	296951	305435	313920	322404	330888	339373
39	277039	285975	294912	303849	312786	321722	330659	339596	348533	357469
40	291428	300829	310230	319631	329032	338432	347833	357234	366635	376036
41	306182	316058	325935	335812	345689	355566	365442	375319	385196	395073
42	321299	331664	342028	352393	362757	373122	383486	393851	404215	414580
43	336781	347645	358509	369373	380237	391101	401965	412829	423693	434557

44	352628	364003	375378	386753	398128	409503	420878	432253	443629	455004
45	368839	380737	392635	404533	416431	428329	440227	452125	464023	475921
46	385413	397846	410279	422712	435144	447577	460010	472442	484875	497308
47	402353	415332	428311	441290	454269	467248	480227	493207	506186	519165
48	419656	433194	446731	460268	473805	487343	500880	514417	527955	541492
49	437324	451431	465539	479646	493753	507860	521967	536075	550182	564289
50	455356	470045	484734	499423	514112	528801	543490	558179	572867	587556
51	473753	489035	504317	519600	534882	550164	565447	580729	596011	611294
52	492513	508401	524288	540176	556063	571951	587838	603726	619613	635501
53	511638	528143	544647	561152	577656	594161	610665	627169	643674	660178
54	531127	548261	565394	582527	599660	616793	633926	651059	668193	685326
55	550981	568755	586528	604302	622075	639849	657622	675396	693170	710943
56	571199	589625	608050	626476	644902	663328	681753	700179	718605	737031
57	591781	610871	629960	649050	668140	687229	706319	725409	744499	763588
58	612727	632493	652258	672023	691789	711554	731320	751085	770850	790616
59	634038	654491	674944	695396	715849	736302	756755	777208	797661	818113
60	655713	676865	698017	719169	740321	761473	782625	803777	824929	846081

Container Diameter (Feet) Height or Length of Container (Feet)

	41	42	43	44	45	46	47	48	49	50
31	231503	237150	242796	248442	254089	259735	265382	271028	276674	282321
32	246680	252696	258713	264729	270746	276763	282779	288796	294812	300829
33	262338	268737	275135	281534	287932	294330	300729	307127	313526	319924
34	278478	285270	292063	298855	305647	312439	319231	326023	332815	339608
35	295100	302298	309495	316693	323890	331088	338286	345483	352681	359878
36	312204	319819	327433	335048	342663	350278	357892	365507	373122	380737
37	329790	337833	345877	353920	361964	370008	378051	386095	394139	402182
38	347857	356341	364826	373310	381794	390278	398763	407247	415731	424216
39	366406	375343	384279	393216	402153	411090	420026	428963	437900	446837

40	385437	394838	404239	413640	423041	432441	441842	451243	460644	470045
41	404950	414827	424703	434580	444457	454334	464211	474087	483964	493841
42	424944	435309	445673	456038	466402	476767	487131	497496	507860	518225
43	445421	456285	467148	478012	488876	499740	510604	521468	532332	543196
44	466379	477754	489129	500504	511879	523254	534629	546004	557379	568755
45	487819	499717	511615	523513	535411	547309	559207	571105	583003	594901
46	509740	522173	534606	547038	559471	571904	584337	596769	609202	621635
47	532144	545123	558102	571081	584060	597040	610019	622998	635977	648956
48	555029	568567	582104	595641	609178	622716	636253	649790	663328	676865
49	578396	592504	606611	620718	634825	648933	663040	677147	691254	705361
50	602245	616934	631623	646312	661001	675690	690379	705068	719757	734445
51	626576	641858	657141	672423	687705	702988	718270	733552	748835	764117
52	651388	667276	683164	699051	714939	730826	746714	762601	778489	794376
53	676683	693187	709692	726196	742701	759205	775710	792214	808718	825223
54	702459	719592	736725	753858	770991	788125	805258	822391	839524	856657
55	728717	746490	764264	782038	799811	817585	835358	853132	870905	888679
56	755456	773882	792308	810734	829160	847585	866011	884437	902863	921288
57	782678	801768	820857	839947	859037	878127	897216	916306	935396	954485
58	810381	830147	849912	869677	889443	909208	928974	948739	968504	988270
59	838566	859019	879472	899925	920378	940831	961283	981736	1002189	1022642
60	867233	888385	909537	930689	951841	972993	994145	1015297	1036449	1057601
Container Diameter (Feet)	Height or Length of Container (Feet)									
	51	52	53	54	55	56	57	58	59	60
31	287967	293614	299260	304907	310553	316199	321846	327492	333139	338785
32	306845	312862	318879	324895	330912	336928	342945	348961	354978	360995
33	326323	332721	339120	345518	351917	358315	364714	371112	377511	383909
34	346400	353192	359984	366776	373568	380360	387153	393945	400737	407529
35	367076	374273	381471	388669	395866	403064	410261	417459	424656	431854

36	388351	395966	403581	411195	418810	426425	434040	441654	449269	456884
37	410226	418270	426313	434357	442401	450444	458488	466532	474575	482619
38	432700	441184	449669	458153	466637	475122	483606	492090	500575	509059
39	455773	464710	473647	482584	491520	500457	509394	518330	527267	536204
40	479446	488847	498248	507649	517050	526451	535851	545252	554653	564054
41	503718	513595	523472	533348	543225	553102	562979	572856	582733	592609
42	528589	538954	549318	559683	570047	580412	590776	601141	611505	621870
43	554060	564924	575788	586652	597515	608379	619243	630107	640971	651835
44	580130	591505	602880	614255	625630	637005	648380	659755	671130	682505
45	606799	618697	630595	642493	654391	666289	678187	690085	701983	713881
46	634067	646500	658933	671365	683798	696231	708663	721096	733529	745962
47	661935	674914	687893	700872	713852	726831	739810	752789	765768	778747
48	690402	703940	717477	731014	744551	758089	771626	785163	798701	812238
49	719469	733576	747683	761790	775898	790005	804112	818219	832326	846434
50	749134	763823	778512	793201	807890	822579	837268	851957	866646	881335
51	779399	794682	809964	825246	840529	855811	871093	886376	901658	916940
52	810264	826151	842039	857926	873814	889701	905589	921476	937364	953251
53	841727	858232	874736	891241	907745	924250	940754	957259	973763	990268
54	873790	890923	908057	925190	942323	959456	976589	993722	1010855	1027989
55	906453	924226	942000	959773	977547	995320	1013094	1030868	1048641	1066415
56	939714	958140	976566	994991	1013417	1031843	1050269	1068695	1087120	1105546
57	973575	992665	1011754	1030844	1049934	1069024	1088113	1107203	1126293	1145382
58	1008035	1027801	1047566	1067331	1087097	1106862	1126628	1146393	1166158	1185924
59	1043095	1063548	1084000	1104453	1124906	1145359	1165812	1186265	1206717	1227170
60	1078754	1099906	1121058	1142210	1163362	1184514	1205666	1226818	1247970	1269122

Note : (1) To convert from cubic feet to gallons, multiply cubic feet by 7.841

(2) An estimate of the number of liquid gallons contained when given the liquid quantity can be obtained by dividing the number of pounds by 8. The exact conversion could be obtained from the chemical composition.

(3) Circular tank conversion formula for volume:

3.1415927, multiplied by the radius of the container squared, multiplied by the height of the container, multiplied by 7.481

$3.1415927 \times r^2 \times h \times 7.481$, where, \times means, "multiplication", and r means, "radius of the container", and h means, "height of the container".

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Basic Data Requirement Checklist

I. Assemble the following geographic information:

1. A map covering the proposed project site and surrounding area up to at least one mile around the area.
2. An aerial photograph of the same area.
3. Sketch the proposed project site boundaries and approximate building locations on the map or photograph.
4. Similarly locate on the map or aerial photograph the positions of:
 - a. Industries handling chemical products
 - b. Storage tanks and their surrounding dikes
 - c. Major highways and roads
 - d. Barge docking areas
 - e. Tanker truck and railroad car terminals

II. Assemble the following information about the hazardous facility:

1. List the chemical name of all substances stored at the facility which pose a potential hazard to the proposed project site (e.g., gasoline, fuel oil, liquefied propane gas, vinyl chloride, etc.).
2. Determine the number of containers involved
3. Determine the distance of the containers to the proposed project site (always measuring from the center of the container)
4. Identify the physical dimensions of all storage containers (height and diameter).
5. Determine the volume (gallons) of each container
6. Note the shape of each container (i.e., spherical, cylindrical)
7. If the storage tanks are horizontal to the ground, which direction do the ends face (parallel or perpendicular to the project site)?
8. Identify each storage container surrounded by a dike. Calculate the dike area (length times the width (in square feet)) for those containers surrounded by a dike. Remember that the secondary containment provided by double walled containers are not considered "diked" containers.
9. Are the storage containers buried underground?
10. What are the general characteristics of the terrain surrounding the storage containers? Does the terrain slope away from the storage tanks toward the proposed HUD-assisted project site?
11. Standing at the proposed HUD-assisted project site is there a clear line of sight to the site deemed hazardous?
12. Are there permanent structures between the project site and the hazard?
13. For each industry located near the proposed HUD-assisted project site, list those facilities serviced by truck, rail or barge.
14. Identify how the storage tanks are filled and emptied:
 - a. Tanker truck. If so, how many gallons does the truck hold? Are the truck tanks compartmentalized?
 - b. Railroad car. If so, how many gallons does the railroad car hold?
 - c. Barge. If so, how many gallons does the barge hold? What is the largest compartment?

- III. List the sources used to locate information for the previous questions. Include the names and the people contacted and their telephone numbers.**

Use additional sheets of paper as needed.

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Request for Headquarters Analysis of Potential Hazardous Site

Name: _____

Date: _____

Title: _____

Field Office: _____

Phone #: _____

Site Profile: _____

Project Name: _____

Project Location (City, County, State): _____

Type of Project

Residential: Yes _____ No _____

Single _____ Multi _____ High rise _____ No. of stories _____ Low rise _____

Elderly: Yes _____ No _____

Rehab _____ Rehab (new use) _____

Non-residential (describe) _____

Potential Problems (for Headquarters to address):

Project Status (include any deadlines):

Additional Information: _____

Project Name: _____

Location: _____

Field Office: _____

Container Data

Contents*	Type**	Number	Size (gallons)	Distance (feet)***
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

* Are the contents stored under Pressure? Yes _____ No _____

** Indicate "D" for diked or "UD" for undiked.

*** Measured from center of the tank

Do any tanks contain toxic or other hazardous materials (e.g. asphyxiants) not covered by 24 CFR Part 51 Subpart C?

Yes _____ No _____ If "yes", briefly describe using categories above.

Describe conditions between tanks and project site (include natural, man-made, and structural barriers):

Project Name: _____

Location: _____

Field Office: _____

Diagrams (illustrate relationship of containers to project site. Include and identify location of industrial storage facilities, proposed site, and relevant roadways, railroad tracks, other buildings, etc.)

Describe any safety measures at the industrial site to minimize the hazard.

Other pertinent information (attachments as necessary)

Acceptable Separation Distance Chart (Thermal Radiation)

Undiked Container Volume (gallons)	Fire Width (Feet)	ASD Bldgs (Feet)	ASD People (Feet)	Diked area (Square feet)	Fire Width (Feet)	ASD Bldgs (Feet)	ASD People (Feet)
100	20	17	106	100	10	9	59
200	28	24	141	200	14	13	79
300	35	29	167	300	17	15	94
400	40	33	189	400	20	17	105
500	45	36	207	500	22	19	116
600	49	40	224	600	24	21	125
700	53	43	238	700	26	23	133
800	57	45	252	800	28	24	141
900	60	48	265	900	30	25	148
1000	63	50	277	1000	32	27	155
2000	89	69	369	2000	45	37	207
3000	110	84	437	3000	55	44	245
4000	126	95	493	4000	63	50	276
5000	141	106	541	5000	71	56	303
6000	155	115	583	6000	77	61	327
7000	167	124	622	7000	84	65	349
8000	179	131	658	8000	89	69	369
9000	190	139	691	9000	95	73	388
10000	200	146	722	10000	100	77	405
20000	283	201	963	20000	141	106	541
30000	346	242	1141	30000	173	128	641
40000	400	277	1286	40000	200	146	723
50000	447	307	1411	50000	224	162	794
60000	490	334	1523	60000	245	176	857
70000	529	358	1624	70000	265	189	914
80000	566	381	1716	80000	283	201	966
90000	600	403	1803	90000	300	212	1015

100000	632	423	1884	100000	316	223	1060
200000	894	582	2514	200000	447	307	1417
300000	1095	702	2977	300000	548	370	1679
400000	1265	802	3356	400000	632	422	1893
500000	1414	889	3683	500000	707	468	2078
600000	1549	968	3974	600000	775	509	2243
700000	1673	1039	4237	700000	837	547	2392
800000	1789	1105	4479	800000	894	582	2529
900000	1897	1167	4705	900000	949	614	2657
1000000	2000	1225	4916	1000000	1000	645	2777

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Acceptable Separation Distance Chart (Blast-Overpressure)

**Tank Volume
(Gallons)**

**ASD
(Feet)**

100	102
200	129
300	147
400	162
500	174
600	185
700	195
800	203
900	212
1000	219
2000	275
3000	315
4000	346
5000	373
6000	396
7000	417
8000	436
9000	453
10000	469
20000	590
30000	674
40000	742
50000	798
60000	848
70000	892
80000	933
90000	970
100000	1004

200000
300000
400000
500000
600000
700000
800000
900000
1000000

1262
1444
1588
1709
1815
1910
1996
2076
2149

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Units of Measure

The following are the units of measure used throughout this guidebook:

Area

Unit of measure	Abbreviation
Square foot	ft ²

Density

Unit of measure	Abbreviation
Kilogram per cubic meter	kg/m ³

Heat of Combustion

Unit of measure	Abbreviation
Kilocalories/Kilogram	kcal/kg
MegaJoules/Kilogram	MJ/kg

Heat Emissivity

Unit of measure	Abbreviation
British Thermal Unit per square foot per hour	BTU/ft ² -hr
Kilowatt per square meter	kw/m ²

Length

Unit of measure	Abbreviation
Meter	m
Centimeter	cm
Kilometer	km
Inch	in
Foot	ft
Mile	mi

Mass

Unit of measure	Abbreviation
Kilogram	kg

Pressure

Unit of measure	Abbreviation
Pounds per square inch	psi

Volume

Unit of measure	Abbreviation
Cubic Meter	m ³
Cubic Centimeter	cm ³
Cubic Inch	in ³
Cubic Foot	ft ³
Ounce	oz
Pint	pt
Quart	qt
Liter	li
U.S. Gallon	gal
British Imperial Gallon	Imp gal

Weight

Unit of measure	Abbreviation
Pounds	lbs